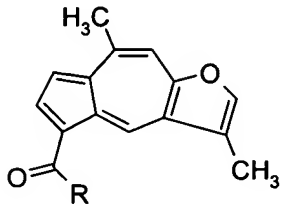
Claims

We claim:

1. A compound having the following structural formula:



wherein R is selected from the group consisting of H, OR_1, and NZ_1Z_2;

R_1 is selected from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl and benzyl;

Z_1 and Z_2 are the same or different and independently chosen from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl, or wherein NZ_1Z_2 represents an amino acid which is linked to the linderazulene nucleus via the nitrogen to form a peptide bond; or a salt thereof.

2. The compound, according to claim 1, selected from the group consisting of 11-carbomethoxylinderazulene (I), 11-formyl linderazulene (II), and salts thereof.

3. The compound, according to claim 1, wherein R= OCH_3.

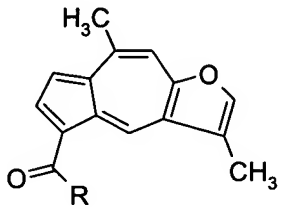
4. The compound, according to claim 1, wherein R= H.

5. The compound, according to claim 1, wherein the compound is a hydrazone or semicarbazone derivative of 11-formyl linderazulene (I).

6. The compound, according to claim 1, having the following spectroscopic properties: UV (MeOH) λ_{max} (ε) 389 (8282), 376 (6381), 325 (11880), 308 (20367), 247 (10048), 228 (11270) nm; IR (NaCl neat) ν_{max} 2946, 2918, 2853, 1678, 1447, 1408, 1387, 1305, 1217, 1188, 1133, 1079, 1056, 939 cm^{-1}; HRFABMS m/z: 255.1033 (calcd for $C_{16}H_{15}O_3$ $[M+H]^+$, 255.1021); ^{13}C (observed at 125 MHz in $CDCl_3$) δ 166.3 s,; 159.1 s, 141.1 s, 141.1 d,139.3 s, 137.0 d,136.3 s, 130.7 d, 126.3 s, 120.3 s, 116.4 s, 116.1 d, 115.7 d, 50.9 q, 25.2 q, and 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) δ 2.45 (s, 3H), 2.93 (s, 3H), 3.94 (s, 3H), 7.28 (d, 3.7), 7.56 (s),7.69 (s), 8.24 (d, 3.7), 9.99 (s).

7. The compound, according to claim 1, having the following the following spectroscopic properties: UV (MeOH) λ_{max} (log ε) 395 (7308), 332 (9385), 316 (13308), 293 (10615), 260 (14284), 215 (12077) nm; IR (NaCl neat) ν_{max} 2956, 2923, 2853, 2746, 1641, 1634, 1398, 1374, 1297, 1286, 1233, 1148, 1081, 1044, 943 cm^{-1}; HRFABMS m/z: 225.0917 (calcd for $C_{15}H_{13}O_2$ $[M+H]^+$, 225.0915); ^{13}C (observed at 125 MHz in $CDCl_3$) 187.1 d, 159.4 s, 141.8 d, 141.7 s, 141.5 s, 141.3 d, 135.1 s, 131.5 d, 126.6 s, 120.5 s, 117.6 d, 117.4 s, 117.4 d, 25.2 q, 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) 10.29 (s), 9.99 (s), 8.09 (d, 3.7), 7.80 (s), 7.56 (s), 7.32 (d, 3.7), 2.94 (s, 3H), 2.46 (s, 3H).

8. A method for inhibiting cellular proliferation, said method comprising administering to a patient in need of such treatment an effective amount of a compound having the following structure:



wherein R is selected from H, OR_1, or NZ_1Z_2;

R_1 is selected from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl and benzyl; and

Z_1 and Z_2 are the same or different and independently chosen from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl or wherein NZ_1Z_2 represents an amino acid which is linked to the linderazulene nucleus via the nitrogen to form a peptide bond; or a salt of said compound.

9. The method, according to claim 8, wherein R=OCH_3.

10. The method, according to claim 8, wherein R=H.

11. The method, according to claim 8, wherein the compound is a hydrazone or semicarbazone derivative of 11-formyl linderazulene (I).

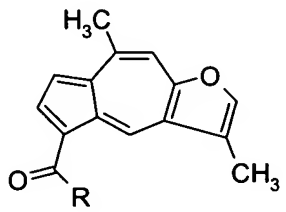
12. The method, according to claim 8, wherein said compound has the following spectroscopic properties: UV (MeOH) λ_{max} (ε) 389 (8282), 376 (6381), 325 (11880), 308 (20367), 247 (10048), 228 (11270) nm; IR (NaCl neat) ν_{max} 2946, 2918, 2853, 1678, 1447, 1408, 1387, 1305, 1217, 1188, 1133, 1079, 1056, 939 cm^{-1}; HRFABMS m/z: 255.1033 (calcd for $C_{16}H_{15}O_3$ $[M+H]^+$, 255.1021); ^{13}C (observed at 125 MHz in $CDCl_3$) δ 166.3 s,; 159.1 s, 141.1 s, 141.1 d,139.3 s, 137.0 d,136.3 s, 130.7 d, 126.3 s, 120.3 s, 116.4 s, 116.1 d, 115.7 d, 50.9 q, 25.2 q, and 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) δ 2.45 (s, 3H), 2.93 (s, 3H), 3.94 (s, 3H), 7.28 (d, 3.7), 7.56 (s),7.69 (s), 8.24 (d, 3.7), 9.99 (s).

13. The method, according to claim 8, wherein said compound has the following spectroscopic properties: UV (MeOH) λ_{max} (log ε) 395 (7308), 332 (9385), 316 (13308), 293 (10615), 260 (14284), 215 (12077) nm; IR (NaCl neat) ν_{max} 2956, 2923, 2853, 2746, 1641, 1634, 1398, 1374, 1297, 1286, 1233, 1148, 1081, 1044, 943 cm^{-1}; HRFABMS m/z: 225.0917 (calcd for $C_{15}H_{13}O_2$ $[M+H]^+$, 225.0915); ^{13}C (observed at 125 MHz in $CDCl_3$) 187.1 d, 159.4 s, 141.8 d, 141.7 s, 141.5 s, 141.3 d, 135.1 s, 131.5 d, 126.6 s, 120.5 s, 117.6 d, 117.4 s, 117.4 d, 25.2 q, 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) 10.29 (s), 9.99 (s), 8.09 (d, 3.7), 7.80 (s), 7.56 (s), 7.32 (d, 3.7), 2.94 (s, 3H), 2.46 (s, 3H).

14. The method, according to claim 8, wherein said cellular proliferation is associated with a condition selected from the group consisting of autoimmune disorders, inflammation, tumors and cancer.

15. The method, according to claim 14 wherein said cancer is selected from the group consisting of breast cancer, colon cancer, CNS cancer, liver cancer, lung cancer, leukemia, melanoma, ovarian cancer, uterine cancer, renal cancer, pancreatic cancer and prostate cancer.

16. A pharmaceutical composition comprising a compound having the following structure:



wherein R is selected from H, OR_1, and NZ_1Z_2;

R_1 is selected from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl and benzyl; and

Z_1 and Z_2 are the same or different and independently chosen from the group consisting of H, C_1 to C_8 alkyl, phenyl, substituted aryl or wherein NZ_1Z_2 represents an amino acid which is linked to the linderazulene nucleus via the nitrogen to form a peptide bond; or a salt of said compound wherein said composition further comprises a pharmaceutically acceptable carrier.

17. The pharmaceutical composition, according to claim 16 comprising a compound in which $R=OCH_3$.

18. The pharmaceutical composition, according to claim 16 comprising a compound in which R=H.

19. The pharmaceutical composition, according to claim 16, comprising a compound which is a hydrazone or semicarbazone derivative of 11-formyl linderazulene (I).

20. The composition, according to claim 16, comprising a compound with the following spectroscopic properties: UV (MeOH) λ_{max} (ε) 389 (8282), 376 (6381), 325 (11880), 308 (20367), 247 (10048), 228 (11270) nm; IR (NaCl neat) ν_{max} 2946, 2918, 2853, 1678, 1447, 1408, 1387, 1305, 1217, 1188, 1133, 1079, 1056, 939 cm^{-1}; HRFABMS m/z: 255.1033 (calcd for $C_{16}H_{15}O_3$ $[M+H]^+$, 255.1021); ^{13}C (observed at 125 MHz in $CDCl_3$) δ 166.3 s,; 159.1 s, 141.1 s, 141.1 d,139.3 s, 137.0 d,136.3 s, 130.7 d, 126.3 s, 120.3 s, 116.4 s, 116.1 d, 115.7 d, 50.9 q, 25.2 q, and 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) δ 2.45 (s, 3H), 2.93 (s, 3H), 3.94 (s, 3H), 7.28 (d, 3.7), 7.56 (s),7.69 (s), 8.24 (d, 3.7), 9.99 (s).

21. The composition, according to claim 16, comprising a compound with the following spectroscopic properties: UV (MeOH) λ_{max} (log ε) 395 (7308), 332 (9385), 316 (13308), 293 (10615), 260 (14284), 215 (12077) nm; IR (NaCl neat) ν_{max} 2956, 2923, 2853, 2746, 1641, 1634, 1398, 1374, 1297, 1286, 1233, 1148, 1081, 1044, 943 cm^{-1}; HRFABMS m/z: 225.0917 (calcd for $C_{15}H_{13}O_2$ $[M+H]^+$, 225.0915); ^{13}C (observed at 125 MHz in $CDCl_3$) 187.1 d, 159.4 s, 141.8 d, 141.7 s, 141.5 s, 141.3 d, 135.1 s, 131.5 d, 126.6 s, 120.5 s, 117.6 d, 117.4 s, 117.4 d, 25.2 q, 8.0 q; ^1H NMR (observed at 500 MHz in $CDCl_3$) 10.29 (s), 9.99 (s), 8.09 (d, 3.7), 7.80 (s), 7.56 (s), 7.32 (d, 3.7), 2.94 (s, 3H), 2.46 (s, 3H).